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Evaluation of the Nutritive Value of Some Commercial Biscuits by Chemical Analysis

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ABSTRACT

The nutrient composition of thirteen different makes of biscuits commonly consumed in Nigeria has been assayed by chemical analyses. The moisture contents ranged from 2·56% to 7·94%. The crude protein ranged from 6·56% DM to 12·7% DM while the crude fat varied from 7·86% DM to 29·1% DM. Crude fibre and ash contents varied from 0·33% DM to 2·03% DM and 0·133% DM to 0·325% DM, respectively. Among the mineral elements determined, calcium and phosphorus were generally low, ranging from 1·0 mg % DM to 5·2 mg % DM and 0·003 mg % DM to 0·028 mg % DM. Ascorbic acid contents were low, ranging from 6·2 mg % DM to 14·3 mg % DM. These results suggest the need for some modification in the recipe used in formulating biscuits with a view to improving the nutrient profile.

INTRODUCTION

In most parts of Nigeria today, there is an increasing tendency towards dependence on ready-made or so-called 'convenience' foods. Such foods include bread, biscuits, meat-rolls, doughnuts, *akara* balls and *moi-moi*

(fried and boiled cowpea preparations, respectively) to mention a few. These foods are served as breakfast and also between meals for both children and adults across the various segments of the population. However, in some homes, especially among the poor peasants, it is not unusual for these convenience foods to form the main substance of the day's meal and hence the major sources of nutrients. The implications of this development have serious and far-reaching consequences for the nutritional status of the Nigerian population. Hence it is necessary to determine the contribution of these convenience foods towards the nutrient requirements of the people. Such information, it is hoped, could assist the planning of nutritional improvement. In these studies, the nutrient composition of some biscuits, commonly sold in the open market in Calabar, is evaluated by chemical analysis.

EXPERIMENTAL

Collection and treatment of samples

Thirteen different makes of biscuit were bought from the open market in Calabar. Five portions of each brand of biscuit (about 10 g each) were pooled and ground with a laboratory grinder (National Model 308, Japan) into powder to pass through a 30 mesh sieve. The ground samples were stored in tightly sealed polythene bags until analysis.

Chemical analysis of samples

The methods used in these studies for proximate analyses were those of Joslyn (1970) and the Association of Official Analytical Chemists (AOAC, 1975). All analyses were carried out in triplicate.

The ground samples were dried to constant weight in an air-draught oven (Astell-Hearson, Great Britain) preset at 60°C. The loss in weight was reported as moisture. The macro-Kjeldahl method was used for nitrogen determination and the crude protein contents expressed as Nx 6·25. Crude fat was estimated by exhaustive extraction of the sample (5 g) with petroleum ether (boiling point 40–60°C) using a Soxhlet apparatus. The fat-free sample after ether extraction was digested alternately with 1·25% H_2SO_4 and 1·25% NaOH under specified conditions. The loss in weight on ignition of the residue at 600°C was reported as crude fibre and the ash content was also noted (AOAC, 1975).

The carbohydrate content (excluding fibre) was obtained by subtracting the sum of crude protein, crude fat, crude fibre and ash from a given weight

TABLE 1
Proximate Composition of Some Biscuits (% Dry Matter)[a]

Biscuit identification code[b]	*Moisture*	*Crude protein*	*Crude fat*	*Crude fibre*	*Ash*	*Total carbohydrate*
B_1	5·56 ± 0·06	12·7 ± 0·4	14·8 ± 0·1	0·43 ± 0·13	0·258 ± 0·002	71·8
B_2	4·55 ± 0·21	10·1 ± 0·1	22·0 ± 0·3	1·53 ± 0·14	0·189 ± 0·001	66·2
B_3	3·25 ± 0·23	6·56 ± 0·53	28·0 ± 0·2	0·33 ± 0·03	0·325 ± 0·023	63·9
B_4	2·97 ± 0·15	9·63 ± 0·16	17·5 ± 0·9	1·72 ± 0·03	0·197 ± 0·004	70·9
B_5	2·76 ± 0·14	8·75 ± 0·10	19·7 ± 0·4	1·74 ± 0·45	0·189 ± 0·001	69·6
B_6	7·94 ± 0·10	7·44 ± 0·30	7·86 ± 0·35	2·00 ± 0·06	0·170 ± 0·001	82·5
B_7	5·76 ± 0·31	7·88 ± 0·02	17·1 ± 0·5	2·03 ± 0·67	0·193 ± 0·002	72·8
B_8	3·75 ± 0·33	8·75 ± 0·10	16·7 ± 0·1	0·73 ± 0·06	0·141 ± 0·003	73·7
B_9	2·98 ± 0·18	8·75 ± 0·10	22·0 ± 0·1	0·91 ± 0·05	0·159 ± 0·003	68·2
B_{10}	5·46 ± 0·02	6·56 ± 0·10	10·2 ± 0·6	0·71 ± 0·05	0·174 ± 0·005	82·4
B_{11}	4·95 ± 0·01	9·19 ± 0·73	14·2 ± 0·7	0·82 ± 0·05	0·210 ± 0·004	75·5
B_{12}	2·56 ± 0·23	7·00 ± 0·7	10·1	1·93 ± 0·04	0·209 ± 0·005	80·7
B_{13}	4·95 ± 0·31	8·13 ± 0·32	29·1 ± 0·1	1·84 ± 0·02	0·133 ± 0·005	60·8

[a] Means of three determinations ± Standard deviation.
[b] Authors can supply further details on request.

TABLE 2
Mineral Composition of Some Biscuits (mg/100 g)[a]

Biscuit identification code[b]	*Sodium*	*Potassium*	*Calcium*	*Phosphorus*	*Magnesium*	*Iron*	*Copper*
B_1	140	25	0·6	0·01	7·2	12·7	0·08
B_2	80	15·6	2·5	0·003	6·5	13·3	0·09
B_3	200	25·0	3·4	0·023	5·3	12·7	0·07
B_4	70	40·1	5·0	0·004	6·5	12·6	0·06
B_5	80	56·3	5·2	0·026	6·6	12·7	0·06
B_6	60	37·5	1·0	0·004	5·6	9·0	0·05
B_7	55	50·4	4·0	0·023	5·7	12·7	0·08
B_8	60	68·8	4·2	0·005	5·8	12·5	0·03
B_9	100	25·0	4·2	0·007	5·2	13·5	0·04
B_{10}	60	62·5	1·5	0·012	5·3	13·7	0·02
B_{11}	60	15·2	1·6	0·009	5·7	12·5	0·04
B_{12}	65	30·5	4·2	0·021	5·0	8·9	0·03
B_{13}	75	13·3	4·2	0·028	5·3	13·5	0·04

[a] Results of one determination.
[b] Authors can supply further details on request.

of the sample. The caloric values were obtained by multiplying the crude protein, fat and carbohydrate contents by factors of 4, 9 and 4, respectively, and expressed as kilocalories. Mineral elements were determined in wet-digests of the samples (Walsh, 1971). Sodium, potassium and calcium were estimated by flame photometry (Gallenkamp Flame Analyser) while magnesium iron and copper were determined using an atomic absorption spectrophotometer. The phosphomolybdate method of Yuen & Pollard (1955) was used for estimation of phosphorus. The method of Scheffert & Kingsley (1955) was adapted for the estimation of total ascorbic acid contents as diketogulonic acid.

RESULTS

Table 1 shows the proximate composition of the biscuits used for studies. The highest value for protein content was 12·7% DM in biscuit type B_1, followed closely by 10·1% DM protein in B_2. The crude fat contents varied widely between 7·86% DM in B_6 and 29·1% DM in B_{13}, but about 70% had crude fat contents of over 15% DM. The crude fibre contents were generally low, and values ranged between 0·33% DM in B_3 and 2·03% DM in B_7. Most of the biscuits had high ash contents with values ranging between 3·25% DM in B_3 and 21·0% DM in B_{11}. B_6 had the highest carbohydrate content of 65·7% DM.

TABLE 3
Total Ascorbic Acid Contents and Energy Values of Some Biscuits

Biscuit identification code[b]	*Total ascorbic acid (mg/100 g sample)*[a]	*Energy values (kcal/100 g sample)*[a]
B_1	6·50	471
B_2	7·25	503
B_3	14·3	542
B_4	11·5	480
B_5	12·5	491
B_6	7·75	431
B_7	7·25	477
B_8	8·75	580
B_9	8·50	506
B_{10}	13·8	448
B_{11}	9·50	467
B_{12}	6·25	442
B_{13}	7·93	537

[a] Results of single determination.
[b] Authors can supply further details on request.

The highest sodium content (Table 2) in the biscuits was 200 mg/100 g DM sample in B_3. The potassium contents varied between 25 mg/100 g DM in B_1 and 68·8 mg/100 g DM in B_8. The calcium contents were generally low, ranging between 0·6 mg/100 g DM and 5·2 mg/100 g DM. The phosphorus contents were also low with the highest value of 0·028 mg/100 g DM in B_{13}. The magnesium contents ranged from 5·0 mg/100 g DM to 7·2 mg/100 g DM sample while the copper contents ranged from 0·02 mg/100 g DM to 0·09 mg/100 g DM in the biscuits. The iron contents varied narrowly between 8·9 mg/100 g DM in B_{12} and 13·5 mg/100 g DM in B_9 and B_{13}, respectively.

Table 3 shows the total ascorbic acid contents and the energy values of the biscuits. The highest ascorbic acid content was 14·3 mg/100 g DM found in B_3. The energy values of the biscuits ranged from 359 kcal/100 g to 485 kcal/100 g sample.

DISCUSSION

The results of these studies, as presented in Tables 1, 2 and 3, show much variation in the contents of the different nutrients assayed among the thirteen types of biscuit. This variation is expected and might be accounted for in part by the different recipes used in formulating the biscuits by the manufacturers. A rather striking observation is the generally low content of nutrients in most of the biscuits. For instance, a consumer would need about 400 g of biscuit type B_1, which incidentally had the highest protein contents, 12·7% DM, to meet a daily allowance of 45 g–50 g of protein recommended for an adult (Fisher & Bender, 1972). The major source of protein in biscuit is wheat, which is deficient in lysine, an essential amino acid. Moreover, soft wheat flour, which is predominantly used for biscuit making (Bohn, 1971) is low in protein. Thus, it is desirable that a lysine-rich protein source should be used to supplement wheat in the recipe for biscuit. The crude fat contents, in about 70% of the biscuits studied, were over 15% DM. The quality of the fat can best be judged by its essential fatty acid composition. Although low dietary fibre is associated with a wide range of diseases (Eastwood, 1974), moderate consumption of these biscuits, having low fibre contents, may not pose a serious problem in a predominantly vegetarian population. The biscuits would hardly be recommended as good sources of calcium and phosphorus to the consumer since their contents of these nutrients are rather low. The same is true of ascorbic acid.

Although the contents of other vitamins were not assayed, literature reports have indicated that the contents of vitamins A, as well as vitamins of the B group, are usually low in biscuits (Umoh & Bassir, 1982). On the basis of the findings in these studies, it is apparent that the biscuits, as presently

formulated, do not contribute much towards the nutritional needs of the consumer. Thus, the practice of substituting biscuit consumption in place of the traditional meals, albeit in response to current socio-economic factors, is bound to complicate the malnutritional problems already rife among the vulnerable segments of the Nigerian population. It is our view that the malnutritional problems would be ameliorated if biscuits, as well as other popular convenience foods, are made more nutritious. This can be done by nutrient fortification of biscuits, a measure which is reportedly practised in some countries (Weisberg, 1976), as a short term measure. For the long term it is advocated that efforts should be directed towards modification of the recipe for biscuits with a view to improving upon the nutrient profile of the finished product.

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